CLAIMS

[Claim(s)]

[Claim 1] The Fe fellows machine amorphous metal thin belt which are 100-900 micrometers in width, and 8-50 micrometers in thickness as a cross-sectional size, and has the magnetic property which shows size Barkhausen discontinuity in a magnetic hysteresis curve, and is characterized by things.

[Claim 2] A cross-section area is 0.0025-0.03mm2. Fe fellows machine amorphous metal thin belt which has the magnetic property which exists and shows size Barkhausen discontinuity in a magnetic hysteresis curve, and is characterized by things.

[Claim 3] The Fe fellows machine amorphous metal thin belt according to claim 1 or 2 which per 10cm in the state where stress is not given is twisted, and the number of times is 0.05 to 3.5 times, and has the magnetic property which shows size Barkhausen discontinuity in a magnetic hysteresis curve where a thin belt is held in Taira and others, and is characterized by things.

[Claim 4] 0. The Fe fellows machine amorphous metal thin belt according to claim 1 or 2 which has the magnetic property which shows size Barkhausen discontinuity in a magnetic hysteresis curve by the critical magnetic field of 7 or less Oe, and is characterized by things.

[Claim 5] The magnetic marker characterized by coming to consist of Fe fellows machine amorphous metal thin belts according to claim 1, 2, 3, or 4.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention has the magnetic property which shows size Barkhausen discontinuity in a magnetic hysteresis curve, relates to the Fe fellows machine amorphous metal thin belt excellent in the pulse voltage generating characteristic, and relates to the

magnetic marker used for the theft prevention which consisted of the thin belt especially, or a goods supervising system.

[0002]

[Description of the Prior Art] It is well known by carrying out rapid cooling of the alloy of a molten state that the amorphous metal material which has various form, such as thin band-like one, the shape of a small-gage wire, and the shape of a powder object, and the characteristic will be obtained. The amorphous metal small-gage wire of Fe and Co basis especially indicated by JP,H1-25941,A and JP,H1-25932,A is set on a magnetic hysteresis curve. It is known as a magnetic material which has the characteristic magnetic property called the size Barkhausen discontinuity which produces magnetization reversal quickly in a certain specific magnetic field value. It is widely applied to various magnetic markers or a magnetometric sensor as a pulse voltage generating element which generates a sharp guidance voltage pulse in a detector coil regardless of the change speed of a magnetization magnetic field.

[0003] On the other hand in the Fe fellows machine amorphous metal thin belt, it was known for the rapid solidification state that size Barkhausen discontinuity is not shown unlike an amorphous metal small-gage wire. However, it was also known in the amorphous metal thin belt which added special thermomechanical treatment that size Barkhausen discontinuity may be shown. For example, it is indicated by JP,H3-27958,B by holding the Fe system amorphous metal thin belt given the twist of 4 times per 10cm at the time of heat treatment at 380 degrees C at the state where it was made Taira and others after heat treatment that size Barkhausen discontinuity is shown in magnetic property. Moreover, it is indicated that it is indicated that the Co system amorphous metal thin belt by which energization heat treatment was carried out shows size Barkhausen discontinuity to the Europe patent public presentation No. 762354 gazette in magnetic property all over a magnetic field, and it can constitute a magnetic marker using them.

[0004]

[Problem to be solved by the invention] The composition which cannot be easily conspicuous as a magnetic marker attached to goods comes to be called for, and length is desirably as small as 7cm or less 10cm or less as the theft prevention using a magnetic marker and a goods supervising system spread in recent years. And the appearance of a new soft magnetism material which makes a thin magnetic marker possible has been demanded. however, when the above mentioned amorphous metal small-gage wire of Fe and Co basis constitutes a magnetic marker It is required for **** (diameter) to be 90 micrometers or more from the relation of the pulse generating characteristic, therefore it had the problem that the whole size became thick, in the magnetic marker by which a small-gage wire is inserted into various film materials or paper.

[0005] 2mm in width by which this invention persons were indicated by JP,H3-27958,B on the

other hand 25-micrometer-thick Fe81Si four B14C1 When the Fe system amorphous metal thin belt to which the twist of 4 times was given per 10cm at the time of 380 degrees C and the heat treatment for 25 minutes was produced using the amorphous metal (number expresses atomic %.) thin belt, the following problem became clear. Namely, it sets on the thin belt whose length is longer than 10cm. In the state where it was twisted after heat treatment, and the number of times is [per 10cm in length of a thin belt] required 4 times or more, the amorphous metal thin belt after heat treatment solved the twist, and it was held in Taira and others although what has the magnetic property which shows size Barkhausen discontinuity was obtained It became clear that the value (critical magnetic field) of the minimum magnetization magnetic field which shows size Barkhausen discontinuity exceeded 0.8 (Oe). And since the critical magnetic field was large, in the small magnetization magnetic field below 0.7 (Oe), a guidance pulse was not generated in a detection coil, but it became clear that the characteristic to be detected could realize only a bad magnetic marker in various anti-theft systems.

[0006] Moreover, it became clear that the length after heat treatment did not show size Barkhausen discontinuity as magnetic property about a thin belt of 10cm or less. That is, the problem that the amorphous metal thin belt after heat treatment had the bad pulse voltage generating characteristic in the state where solved the twist and it was held in Taira and others, and a thin magnetic marker could not be constituted small became clear. Since [furthermore,] it is twisted and there is also much number of times per 10cm in length of a thin belt as 4 times or more When cutting of a thin belt arose frequently, rolled round the thin belt after heat treatment in a bobbin or picked out a thin belt from a bobbin at the time of heat treatment, in order [being intense] to be twisted, the problem that a thin belt being narrow or being twisted arose frequently became clear. Moreover, if the magnetic marker which held the thin belt after heat treatment in the even state with the film of an organic material is produced It became clear to also have the problem of a magnetic marker being strongly twisted for rigidity with an expensive Fe system amorphous metal thin belt, and becoming difficult although it is hard to deal with it, and the problem of becoming easy to separate from the goods which the magnetic marker attached.

[0007] Moreover, [when this invention persons heat-treat a Co system amorphous metal thin belt using energization heat treatment technology all over the magnetic field indicated in the Europe patent public presentation No. 762354 gazette and examine the magnetic property, it is shown that size Barkhausen discontinuity is shown in the magnetic property of 10cm in length a thin belt, but] It became clear that the value (critical magnetic field) of the minimum magnetization magnetic field which shows size Barkhausen discontinuity exceeded 0.8 (Oe). And since the critical magnetic field of the thin belt is large, when a magnetic marker is constituted using a thin belt, in the small magnetization magnetic field below 0.7 (Oe), a

guidance pulse is not generated in a detection coil. In various anti-theft systems, the characteristic to be detected was bad, and it became clear that a practical magnetic marker could not be offered.

[0008] Therefore, also in a length of 10cm or less, size Barkhausen discontinuity is shown as magnetic property. and -- a marker is twisted when the critical magnetic field which shows size Barkhausen discontinuity constitutes a small amorphous metal material for magnetic markers, and a magnetic marker -- ****** -- being hard -- development of a thin amorphous metal material was desired.

[0009] The purpose of this invention has the value of the critical magnetic field with which it indicates size Barkhausen discontinuity to be 10cm or less as magnetic property even when length is small, and it indicates size Barkhausen discontinuity to be in offering the amorphous metal material which is below 0.7 (Oe). Moreover, other purposes of this invention are to offer the thin small magnetism marker which consisted of amorphous metal material which shows such size Barkhausen discontinuity.

[0010]

[Means for solving problem] This invention persons set on a Fe fellows machine amorphous metal thin belt, as a result of inquiring wholeheartedly that the above-mentioned purpose should be attained. What has specific cross-sectional form has the magnetic property which shows size Barkhausen discontinuity in a magnetic hysteresis curve also in a length of 10cm or less, And it found out being obtained even when it is that what also has the critical small magnetic field which shows size Barkhausen discontinuity is obtained, and a thin belt with still few twists which hold the characteristic, and this invention was completed.

[0011] That is, the 1st invention makes a summary the Fe fellows machine amorphous metal thin belt which are 100-900 micrometers in width, and 8-50 micrometers in thickness as a cross-sectional size, and has the magnetic property which shows size Barkhausen discontinuity in a magnetic hysteresis curve, and is characterized by things. Moreover, the cross-section area of the 2nd invention is 0.0025-0.03mm2. It has the magnetic property which exists and shows size Barkhausen discontinuity in a magnetic hysteresis curve, and let the Fe fellows machine amorphous metal thin belt characterized by things be a summary. Furthermore, the 3rd invention is in the state where per 10cm in the state where stress is not given is twisted, and the number of times is 0.05 to 3.5 times, and the thin belt was held in Taira and others. It has the magnetic property which shows size Barkhausen discontinuity in a magnetic hysteresis curve, and let the Fe fellows machine amorphous metal thin belt said 1 or given in two characterized by things be a summary. Furthermore, the 4th invention is the critical magnetic field of 0.7 or less Oe, has the magnetic property which shows size Barkhausen discontinuity in a magnetic hysteresis curve, and makes a summary the Fe fellows machine amorphous metal thin belt said 1 or given in two characterized by things again.

Furthermore, the 5th invention makes a summary the magnetic marker characterized by coming to consist of Fe fellows machine amorphous metal thin belts said 1, 2, 3, or given in four again.

[0012]

[Mode for carrying out the invention] This invention is explained concretely hereafter, referring to Drawings. Although the amorphous metal thin belt of this invention needs to have the amorphous structure checked by X diffraction experiment, in the limitation from which the magnetic property which shows size Barkhausen discontinuity in a magnetic hysteresis curve is acquired, ******** may be contained a little in the state where it was held at the even state.

[0013] In this invention, it is required for the width of an amorphous metal thin belt to be 100-900 micrometers. Even when the width of a thin belt is set to 900 micrometers or less and length is 10cm or less, a magnetization magnetic field shows size Barkhausen discontinuity to below 0.7Oe (Oersted) (that is, a critical magnetic field shows the size Barkhausen discontinuity of 0.7 or less Oe). And even if it constitutes the magnetic marker which consists of structure where the thin belt of this invention was inserted into the film or paper which consists of an organic material, it has the advantage that a sharp guidance pulse with the big voltage value and the high order harmonics ingredient accompanying size Barkhausen discontinuity can be generated. Moreover, in order to acquire the magnetic property which has size Barkhausen discontinuity in 2 or less times per 10cm of the number of times of a twist in the case of heat treatment in order to obtain the amorphous metal thin belt in which the size Barkhausen discontinuity of a critical small magnetic field is shown by the heat treatment back, it is desirable that width is 150-800 micrometers. furthermore -- in this invention -- more -- length -- in order for a critical magnetic field to acquire magnetic property with small size Barkhausen discontinuity in a short small thin belt, it is desirable that width is 150-700 micrometers.

[0014] [here / what / the value of a critical magnetic field / what shows size Barkhausen discontinuity will show the tendency which becomes large, or] if width becomes larger than 900 micrometers Even if it heat-treats by making various the number of times of a twist given per 10cm at the time of heat treatment, heat treatment temperature, and heat treatment time change, the length after heat treatment ceases to show size Barkhausen discontinuity about a thin belt of 10cm or less. Moreover, even if the magnetic property width indicates size Barkhausen discontinuity to be in a magnetic hysteresis curve is acquired, the problem that the voltage of the pulse guided becomes low generates the thin belt below 100 micrometers. In addition, the "width" in the amorphous metal thin belt of this invention is the distance between the ends in arbitrary sections (the maximum size of a transverse direction), and there are various things shown in drawing 1 -3 as a cross-sectional form.

[0015] In this invention, it is required for the thickness of an amorphous metal thin belt to be 8-

50 micrometers. Moreover, from a viewpoint of the manufacturability of the thin belt in a liquid quenching method, it is desirable that thickness is 15-45 micrometers. Here, even if the magnetic property the thickness of a thin belt indicates size Barkhausen discontinuity to be in a magnetic hysteresis curve by less than 8 micrometers is acquired, the problem that the voltage of the pulse guided becomes low occurs. Moreover, if thickness exceeds 50 micrometers, even if amorphous-ization of material heat-treats by not being enough, the magnetic property which shows size Barkhausen discontinuity will not be acquired, or material will become weak easily, and it will become easy to produce cutting in the process which produces the time of twist heat treatment, and a magnetic marker.

[0016] Furthermore, in this invention, it is desirable for the ratio (size ratio) to the width of the thickness of an amorphous metal thin belt to be 0.4 or less [0.015 or more]. Moreover, from a viewpoint of the magnetic property of a thin belt, or the manufacturability of a thin belt, it is more desirable that the ratio to the width of thickness is 0.35 or less [0.02 or more]. Furthermore, in order to acquire the magnetic property in which a critical magnetic field has small size Barkhausen discontinuity in a thin belt with it in this invention again, it is most desirable that the ratio to the width of thickness is 0.30 or less [0.05 or more]. [short length and] [smaller]

[0017] In this invention, when the ratio to the width of thickness exceeds 0.4, since width is too narrow when becoming a weak material or manufacturing a narrow width thin belt from a double width thin belt by the mechanical judging method, since a cooling rate becomes less enough [at the time of thin belt production] in a liquid quenching method, there is a tendency for manufacture to become difficult. Moreover, that the amorphous metal thin belt in which the size Barkhausen discontinuity of a critical small magnetic field is shown after heat treatment will be hard to be obtained if the ratio to the width of thickness becomes less than 0.015 [become or] Even if it heat-treats by making various heat treatment conditions, such as the number of times of a twist given per 10cm at the time of heat treatment, and heat treatment temperature, heat treatment time, change, that the length after heat treatment does not indicate size Barkhausen discontinuity to be about a thin belt of 10cm or less also comes to be obtained. .

[0018] Furthermore, in this invention, the cross-section area of an amorphous metal thin belt is 0.0025mm2. It is 0.03mm2 above. It is required to be the following. Moreover, the cross-section area from a viewpoint of the magnetic property of a thin belt or the manufacturability of a thin belt is 0.003mm2. It is 0.0275mm2 above. It is desirable that it is the following and it is 0.005mm2 especially. It is 0.025mm2 above. It is desirable that it is the following. Furthermore, in order to acquire the magnetic property in which a critical magnetic field has small size Barkhausen discontinuity in a thin belt with it in this invention again, the cross-section area of a thin belt is 0.005mm2. It is 0.02mm2 above. It is most desirable that it is the following. [short

length and] [smaller] In this invention, a cross-section area is 0.0025mm2. If it becomes the following, the pulse voltage generated even if manufacture becomes difficult or the size Barkhausen characteristic is shown after heat treatment, when manufacturing a thin belt by the liquid quenching method or the mechanical judging method will become low, and will become scarce at practicality. moreover, a cross-section area -- 0.03mm2 if it exceeds, even if it heat-treats on condition of versatility, the length after heat treatment does not show size Barkhausen discontinuity about a thin belt of 10cm or less -- ** -- **

[0019] The thin belt in this invention is twisted, per m in length is twisted in the state where shall count with 1 time by 360-degree rotation, and stress is not given with the number of times, the number of times or a twist angle shall be measured, per 10cm shall be twisted, and the number of times shall be computed. And in this invention, in the thin belt which twisted in order to give the size Barkhausen discontinuous characteristic, and was processed by heat treatment, while width, thickness, a cross-section area, etc. which were mentioned above satisfy the peculiar cross-sectional form of this invention, it is desirable that the number of times of a twist is 3.5 or less [0.05 or more]. Moreover, for acquiring the size Barkhausen discontinuous characteristic where the critical magnetic field was stabilized more, it is more desirable that the number of times of a twist of the thin belt after heat treatment is 0.1 times [3 or less] or more. If the number of times of a twist per 10cm of thin belts becomes less than 0.05 times here, the tendency for the length of a thin belt required in order to show size Barkhausen discontinuity in the state where the thin belt was held in Taira and others to become long will be accepted. Moreover, a rigidity high in a critical magnetic field becoming high when a twist is canceled and a thin belt is fixed on a plane, in order to produce a magnetic marker even if size Barkhausen discontinuity is shown as magnetic property, when the number of times of a twist increases more than 3.5 times sake, A magnetic marker will be twisted strongly and handling will become difficult.

[0020] In the Fe fellows machine amorphous metal thin belt of this invention, it is the alloy as for which more than 65 atom % contains at least one sort of Fe, Co, and nickel, and if amorphous single phase is formed, there will be no limitation in particular of composition. However, in more than 65 atom %, the sum total of the element of one sort or two sorts or more of Fe fellows machines as which nickel was chosen from Fe, Co, and nickel in the range below 35 atom % [below 90 atom %] alloy **** as for which below 35 atom % contains [more than 10 atom %] in total one sort or two sorts or more of elements chosen from the group of B, P, C, Si, aluminum, Ga, Zr, Nb, and Ta as an element which promotes amorphous formation -- things are desirable. Furthermore, in this invention, if it has the magnetic property which shows size Barkhausen discontinuity in a magnetic hysteresis curve even if W, V, Cr, Cu, and Mo are contained below as for 10 atom % in order to improve corrosion resistance to alloy composition, there will be no problem in particular.

[0021] If the sum total content of the element of Fe fellows machine becomes under 65 atom % in this invention, magnetic property will be deteriorated, and there is a tendency to stop showing size Barkhausen discontinuity in the magnetic hysteresis curve in room temperature. Moreover, if it becomes when the sum total content of the element of Fe fellows machine exceeds 90 atom %, or when the sum total of the element which promotes amorphous formation exceeds under 10 atom % and 35 atom % The amorphous metal thin belt in which amorphous organization potency falls to, it becomes difficult to form amorphous single phase in, and size Barkhausen discontinuity is shown in a magnetic hysteresis curve becomes is hard to be obtained.

[0022] Moreover, as length shows the amorphous metal thin belt of this invention to drawing 4 -5 on a magnetic hysteresis curve in 10cm or less The size Barkhausen discontinuity which produces magnetization reversal quickly in a certain specific magnetization magnetic field value (a critical magnetic field value is called hereafter) is shown, and it is accompanied by 30% or more of the amount of magnetization change of the saturation magnetization (saturation magnetic flux density) of material in the steep magnetization reversal. Furthermore, when taking the application to a magnetic marker into consideration, that length indicates size Barkhausen discontinuity to be by 7cm or less is desirable.

[0023] Moreover, the amorphous metal thin belt of this invention is wanted to be below 0.7 (Oe) as a critical magnetic field value which the magnetization reversal accompanying size Barkhausen discontinuity produces. Furthermore, as a magnetic material for magnetic markers, it is still more desirable that the value of a critical magnetic field is below 0.6 (Oe), and it is most desirable especially that it is 0.05-0.5 (Oe). Here, when the critical magnetic field value of size Barkhausen discontinuity exceeded 0.7 (Oe) and a magnetic marker is constituted, the characteristic of a marker to be detected worsens and there is a tendency for practicality to fall.

[0024] In addition, the amorphous metal thin belt of this invention generates the wave-like sharp guidance voltage pulse accompanying size Barkhausen discontinuity in a police box magnetic field. Moreover, it is obtained with the amplitude whose harmonics ingredient of the pulse voltage to generate is also sufficiently high to a high order ingredient. Therefore, the amorphous metal thin belt of this invention is the magnetic material which can be widely used for various magnetic markers or a magnetometric sensor as a pulse voltage generating element.

[0025] The magnetic marker of this invention needs to use the aforementioned amorphous metal thin belt as an element for pulse generating. And various forms can be taken as marker composition. for example, ****** held at the state (even state) where the amorphous metal thin belt had **** canceled in this invention although drawing 6 shows the composition of the typical magnetic marker -- things are desirable. The amorphous metal thin belt 1 in a figure is cut and

arranged at predetermined length on the base material film 2 with which the adhesive was applied. And it is put with the base material film 3 with which the adhesive was applied from the upper part of the thin belt. Here, as a base material which puts a thin belt in the even state, what consists of various organic material, such as polyethylene terephthalate and paper, can be used. Moreover, as thickness of a base material, 0.5-200-micrometer various things can be used, and it is also possible to use the base material which consists of two or more sorts of material according to the purpose. In addition, what is necessary is just to use a thing with an adhesive (for it not to be visible by a diagram) at the back of a base material film in the magnetic marker used for goods surveillance, in such a case, although a marker needs to make a detected material paste.

[0026] Moreover, what is necessary is just to use a half-rigid magnetic material with which coercive force exceeds 30 (Oe) with an amorphous metal thin belt, in order to be able to take two kinds of states of the state which shows the state (it is called an inactivation state below) which does not show the marker characteristic, and the marker characteristic as a magnetic marker. For example, drawing 7 shows one embodiment of the magnetic marker of this invention which can take an inactivation state by the mimetic diagram. In drawing 7 , the half-rigid magnetic material 4 is arranged around the amorphous metal thin belt 1 in the form of two or more bits. When such a magnetic marker gives a magnetic field which exceeds 50 (Oe) from the exterior, the half-rigid magnetic material 4 is magnetized and the amorphous metal thin belt 4 is exposed under a bias magnetic field. Therefore, it will be maintained at the inactivation state where remarkable pulse voltage is not generated even when a magnetic marker is placed into an external police box magnetic field after that.

[0027] The Fe fellows machine amorphous metal thin belt of this invention is manufactured by being heat-treated, after being produced by a liquid quenching method so that it may have the above-mentioned peculiar cross-sectional size. If it is the method by which the amorphous metal thin belt which has the cross-sectional form of this invention is obtained as a liquid quenching method, it will not be limited in particular for the manufacture method, but it is desirable to produce using the **** sampling process, the centrifugal rapid cooling method, the single rolling method, or the ** rolling method conventionally known as a liquid quenching method. For example, when using the single rolling method as a liquid quenching method, an alloy is fused in the nozzle made from Ceramics Sub-Division which has a hole at a tip. By making a revolving copper roll blow off from a nozzle hole, and carrying out the rapid solidification of the melting alloy to it, can manufacture the amorphous metal thin belt of this invention, and as typical manufacture conditions A cross-section area is 0.2mm2. The nozzle made from Ceramics Sub-Division which has the following nozzle holes is used. On the copper roll which rotates with the peripheral velocity of 5 - 50 m/s, it is a nozzle hole to a melting alloy in the atmosphere, a vacuum, or inactive gas atmosphere, such as argon, 0.005kg/cm2 What

is necessary is just to make it blow off by the above pressure. Moreover, a double-width amorphous metal thin belt is manufactured with a liquid quenching method, and if the amorphous metal thin belt which has the cross-sectional form of this invention also by the method of manufacturing the amorphous metal thin belt of a narrow width by the mechanical decision method (slit) is obtained from the thin belt, there will be no problem in particular.

[0028] As the heat treatment method of the amorphous metal thin belt concerning this invention Especially if it is the method by which the amorphous metal thin belt in which size Barkhausen discontinuity is shown in a magnetic hysteresis curve after heat treatment is obtained, it will not be limited, but it is in the state which hardly gives a twist and tension to the thin belt of this invention as the desirable heat treatment method. The method of heat-treating in 0.1 to 100000 seconds in the temperature range below 250-degree-C or more crystallization temperature, Where 0.05 to 3.5 twists are given as the number of times of a twist per 10cm in length of a thin belt, it sets in the temperature range below 250-degree-C or more crystallization temperature. 0.05 to 3.5 twists are given as the method of heat-treating in 0.1 to 100000 seconds, and the number of times of a twist per 10cm in length of a thin belt, and it is 0.05-130kg/mm2 to the longitudinal direction of a thin belt further. where tension is also given In the temperature range below 250-degree-C or more crystallization temperature, the method of heat-treating in 0.1 to 100000 seconds etc. is mentioned.

[0029] moreover, as methods other than the above-mentioned heat treatment method Even if it uses the heat treatment method which impresses a magnetic field using the amorphous metal thin belt which has the peculiar cross-sectional form concerning this invention at the time of the method of energizing at the time of heat treatment, or heat treatment, and energizes further, the thin belt of this invention which has the good size Barkhausen discontinuous characteristic is manufactured. As heat treatment conditions for realizing the size Barkhausen discontinuous characteristic of having a critical small magnetic field especially The method of energizing a direct current or exchange current of the size of 0.01-20A to the longitudinal direction of a thin belt in the temperature range below 200-degree-C or more crystallization temperature, The method of energizing a direct current or exchange current of the size of 0.01-20A to the longitudinal direction of a thin belt all over a direct current or police box magnetic field of 0.05-20 (Oe) is employable.

[0030]

[Working example] Next, an example and a comparative example explain this invention concretely.

The rapid cooling thin belt was produced using the single rolling method about the alloy which consists of various composition shown in one to example 1-13 and comparative example 9 table 1. In addition, in the single rolling method, melting of the various alloys of Table 1 is carried out in the quartz nozzle equipped with a nozzle hole 80-900 micrometers in diameter

under argon atmosphere. On the copper roll 20cm in diameter which rotates at 1000-4500rpm, it is **** Argon blow-of-gas pressure 0.5-4 kg/cm2 The rapid cooling metal thin belt was produced by spouting. The distance of the quartz nozzle at this time and a rotation cooling roller side was 1mm or less. Next, where a twist of 0.5 times is given for the produced rapid cooling thin belt per 10cm in 380 degrees C, heat treatment for 25 minutes was performed.
[0031] The existence of the size Barkhausen discontinuity in the organization, the width, the thickness, the pulse voltage, and the magnetic hysteresis curve of these produced thin belts was measured. The result is shown in Table 1. About the organization, it judged that the state where the Harrow pattern peculiar to amorphous ** was obtained by the X-ray diffraction method is amorphous, and the state where crystalline material was intermingled as it is amorphous was judged here to be crystalline material. Moreover, ten sections were observed with the optical microscope (OPTIPHOT, NIKON CORP. make), and thickness was computed with Haba as average value of ten sections. And the ratio (t/w) to the width (w) of thickness (t) was computed using the average value. Furthermore, by measuring an exchange magnetic hysteresis curve about magnetic property in the magnetization magnetic field 0.01-1 (Oe) and the frequency of 60Hz using the thin belt of 20cm of sample length who held in the even state The critical magnetic field value which the existence of size Barkhausen discontinuity and size Barkhausen discontinuity produce was judged. Furthermore, the pulse voltage generating characteristic of the produced amorphous metal thin belt magnetized the thin belt by the sine wave of the frequency of 50Hz, and the impression maximum magnetic field 1 (Oe), and measured the pulse voltage detected with 3.5cm in length, 590 turns, and the detector coil with an inside diameter of 3cm which were wound around the circumference of the amorphous metal thin belt central part again.
[0032]
[Table 1]

	組成 [原子%]	組織	厚さ [μm]	幅 [μm]	厚さと幅との比	大バルクハウゼン不連続の有無	臨界磁界 (Oe)	検出パルス電圧(mV)
実施例1	$Fe_{78}Si_9B_{13}$	非晶質	35	652	0.054	有り	0.38	85
実施例2	$Fe_{78}Si_9B_{13}$	非晶質	16	800	0.020	有り	0.33	79
実施例3	$Fe_{78}Si_9B_{13}$	非晶質	43	295	0.146	有り	0.39	78
実施例4	$Fe_{78}Si_9B_{13}$	非晶質	15	728	0.021	有り	0.37	73
実施例5	$Fe_{78}Si_9B_{13}$	非晶質	44	150	0.293	有り	0.33	71
実施例6	$Fe_{67}Co_{11}Si_9B_{13}$	非晶質	25	610	0.041	有り	0.34	82
実施例7	$Fe_{18}Co_{60}Si_9B_{13}$	非晶質	28	615	0.046	有り	0.35	76
実施例8	$Fe_{60}Ni_{18}Si_7B_{15}$	非晶質	33	605	0.055	有り	0.38	72
実施例9	$Fe_{60}Co_{10}Ni_{18}Si_7B_{15}$	非晶質	32	618	0.052	有り	0.32	73
実施例10	$Fe_{60}Co_5Ni_{33}Si_7B_{15}$	非晶質	31	620	0.050	有り	0.36	71
実施例11	$Co_{72}Si_{13.5}B_{14.5}$	非晶質	33	605	0.055	有り	0.38	72
実施例12	$Fe_{76}P_{13}C_7Cr_3Mo_1$	非晶質	31	620	0.050	有り	0.36	71
実施例13	$Fe_{83}Zr_7B_7Cu_1Nb_2$	非晶質	33	605	0.055	有り	0.38	72
比較例1	$Fe_{78}Si_9B_{13}$	非晶質	25	1050	0.024	無し	----	56
比較例2	$Fe_{81}Si_4B_{14}C_1$	非晶質	25	2000	0.013	無し	----	45
比較例3	$Fe_{78}Si_9B_{13}$	非晶質	35	98	0.357	有り	0.32	36
比較例4	$Fe_{78}Si_9B_{13}$	非晶質	7	330	0.021	有り	0.36	26
比較例5	$Fe_{78}Si_9B_{13}$	結晶質	65	239	0.27	無し	----	12
比較例6	$Fe_{78}Si_9B_{13}$	結晶質	55	98	0.561	無し	----	13
比較例7	$Fe_{33}Co_{55}Cr_{20}Si_9B_{13}$	非晶質	32	302	0.106	無し	----	--*
比較例8	$Fe_{53}Cr_{33}Si_9B_{13}$	非晶質	22	262	0.084	無し	----	--*
比較例9	$Fe_{64}Si_{13}B_{20}$	結晶質	18	289	0.062	無し	----	12

＊検出されず。

[0033] As shown in Table 1, the Fe fellows machine amorphous thin belt of this invention showed size Barkhausen discontinuity in the magnetic hysteresis curve reflecting the peculiar cross-sectional form of this invention, and the magnetic property of under 0.5 (Oe) was acquired also for each critical magnetic field value at the time of magnetization reversal. Therefore, the guidance pulse generated in a detector coil is also a wave-like sharp pulse, and it is clear that its all have the outstanding pulse voltage generating characteristic of 70mV or more, and are excellent in the characteristic to be detected.

[0034] However, [exceed / width / as shown in comparative examples 1 and 2 / 900 micrometers] or [the thin belt with which the ratio to the width of thickness has less than 0.015 section] where a twist of 1 time is given per 10cm at the time of heat treatment even if it was amorphous structure, size Barkhausen discontinuity was not shown in magnetic property, but the pulse voltage to generate was also markedly boiled compared with the example 1-13, and became low. Moreover, like comparative examples 3 and 4, even if width showed size Barkhausen discontinuity, since pulse voltage was low, the practicality to a magnetic marker etc. had it. [low / it was amorphous structure, and / when less than 100 micrometers and thickness were less than 8 micrometers] Furthermore, the thin belt which has the cross-sectional form in which thickness exceeds 45 micrometers like comparative examples 5 and 6, or the ratio to the width of thickness exceeds 0.4 did not have the enough rapid cooling effect at the time of manufacture, amorphous structure was not acquired, and size Barkhausen

discontinuity was not shown in magnetic property, either. Furthermore, even if each sum total content of Fe fellows element was under 65 atom % and comparative examples 7 and 8 were amorphous structures, pulse voltage was not detected again for the nonmagnetic thin belt. Furthermore, since a comparative example 9 had too much content of the element which promotes amorphous formation, its pulse voltage which cannot form amorphous structure on the contrary, and does not show size Barkhausen discontinuity, but is generated was also very low again.

[0035] Cross-sectional form and magnetic property were examined like the example 1 except each thin belt of 14 to example 26 example 1-13 being 10cm in length. The result is shown in Table 2.

[0036]

[Table 2]

	組成 [原子%]	組織	厚さ [μm]	幅 [μm]	厚さと幅との比	大ﾊﾞﾙﾊｳｾﾞﾝ不連続の有無	臨界磁界 (Oe)	検出パルス電圧(mV)
実施例14	$Fe_{78}Si_9B_{13}$	非晶質	35	652	0.054	有り	0.36	84
実施例15	$Fe_{78}Si_9B_{13}$	非晶質	16	800	0.020	有り	0.32	77
実施例16	$Fe_{78}Si_9B_{13}$	非晶質	43	295	0.146	有り	0.37	77
実施例17	$Fe_{78}Si_9B_{13}$	非晶質	15	728	0.021	有り	0.35	72
実施例18	$Fe_{78}Si_9B_{13}$	非晶質	44	150	0.293	有り	0.32	70
実施例19	$Fe_{67}Co_{18}Si_9B_{13}$	非晶質	25	610	0.041	有り	0.32	80
実施例20	$Fe_{18}Co_{60}Si_9B_{13}$	非晶質	28	615	0.046	有り	0.33	75
実施例21	$Fe_{60}Ni_{18}Si_7B_{16}$	非晶質	33	605	0.055	有り	0.35	72
実施例22	$Fe_{60}Co_{10}Ni_{18}Si_7B_{15}$	非晶質	32	618	0.052	有り	0.31	71
実施例23	$Fe_{60}Co_8Ni_{25}Si_7B_{15}$	非晶質	31	620	0.050	有り	0.35	71
実施例24	$Co_{72}Si_{13.5}B_{14.5}$	非晶質	33	605	0.055	有り	0.37	73
実施例25	$Fe_{76}P_{13}C_7Cr_3Mo_1$	非晶質	31	620	0.050	有り	0.35	72
実施例26	$Fe_{68}Zr_7B_7Cu_1Nb_2$	非晶質	33	605	0.055	有り	0.35	71

[0037] As shown in Table 2, the Fe fellows machine amorphous thin belt of this invention reflects the peculiar cross-sectional form of this invention, even when length is set to 10cm. Size Barkhausen discontinuity was shown in the magnetic hysteresis curve, the critical magnetic field value at the time of magnetization reversal hardly changed to the case where length is 20cm, either, but the magnetic property of under 0.5 (Oe) was acquired for all. Therefore, the guidance pulse generated in a detector coil is also a wave-like sharp pulse, and it is clear that its all have the outstanding pulse voltage generating characteristic of 70mV or more, and are excellent in the characteristic to be detected.

[0038] It heat-treated by producing a rapid cooling thin belt using the single rolling method like an example 1 about the alloy which consists of various composition shown in ten to example 27-39 and comparative example 13 table 3. The existence of the size Barkhausen discontinuity in the organization, Haba, the thickness, the cross-section area, the pulse voltage, and the magnetic hysteresis curve of these produced thin belts and the size of the critical magnetic field were measured like the example 1. The result is shown in Table 3.

[0039]

[Table 3]

	組成 [原子%]	組織	厚さ [μm]	幅 [μm]	断面積 [mm²]	大バルクハウゼン不連続の有無	臨界磁界 (Oe)	検出パルス電圧(mV)
実施例27	$Fe_{78}Si_9B_{13}$	非晶質	37	280	0.0088	有り	0.38	85
実施例28	$Fe_{78}Si_9B_{13}$	非晶質	41	260	0.0095	有り	0.33	79
実施例29	$Fe_{78}Si_9B_{13}$	非晶質	45	786	0.0300	有り	0.39	78
実施例30	$Fe_{78}Si_9B_{13}$	非晶質	15	700	0.0089	有り	0.37	73
実施例31	$Fe_{78}Si_9B_{13}$	非晶質	45	150	0.0057	有り	0.33	71
実施例32	$Fe_{39}Co_{39}Si_9B_{13}$	非晶質	32	296	0.0081	有り	0.34	82
実施例33	$Fe_{16}Co_{62}Si_9B_{13}$	非晶質	28	310	0.0074	有り	0.35	76
実施例34	$Fe_{60}Ni_{18}Si_9B_{13}$	非晶質	33	345	0.0097	有り	0.38	72
実施例35	$Fe_{30}Co_{30}Ni_{18}Si_9B_{13}$	非晶質	35	288	0.0096	有り	0.32	73
実施例36	$Fe_{30}Co_{16}Ni_{30}Si_7B_{16}$	非晶質	45	460	0.0197	有り	0.36	71
実施例37	$Co_{72.5}Si_{13.5}B_{14}$	非晶質	36	285	0.0097	有り	0.31	72
実施例38	$Fe_{78}P_{13}C_7Cr_2$	非晶質	31	315	0.0093	有り	0.34	85
実施例39	$Fe_{63}Zr_7B_6Cu_1Nb_3$	非晶質	26	327	0.0072	有り	0.35	74
比較例10	$Fe_{78}Si_9B_{13}$	非晶質	25	1050	0.0223	無し	----	56
比較例11	$Fe_{78}Si_9B_{13}$	非晶質	18	2000	0.0425	無し	----	45
比較例12	$Fe_{78}Si_9B_{13}$	非晶質	35	98	0.0029	有り	0.31	36
比較例13	$Fe_{78}Si_9B_{13}$	非晶質	7	330	0.0021	有り	0.34	26

[0040] As shown in Table 3, the Fe fellows machine amorphous thin belt of the example 27-39 of this invention reflects the peculiar cross-sectional form of this invention. The magnetic property which shows size Barkhausen discontinuity in a magnetic hysteresis curve is acquired, and each critical magnetic field of the size Barkhausen discontinuity had also become the good thing of under 0.5 (Oe). And the guidance pulse generated in a detector coil is also a wave-like sharp pulse, and it is clear that its all have the outstanding pulse voltage generating characteristic of 70mV or more.

[0041] However, as shown in comparative examples 10 and 11, width exceeds 900 micrometers or a cross-section area is 0.03mm2. [the thin belt which has the section to exceed] the magnetic property which shows size Barkhausen discontinuity in a magnetic hysteresis curve was not acquired, but the pulse voltage to generate was also markedly boiled compared with the example 27-39, and became low. Moreover, a cross-section area when width is [less than 100 micrometers and thickness] less than 8 micrometers like comparative examples 12 and 13 is 0.0025mm2. When it was the following, even if size Barkhausen discontinuity was shown, since pulse voltage was low, the practicality to a magnetic marker etc. was low [it was amorphous structure, and].

[0042] Cross-sectional form and magnetic property were examined like the example 27 except each thin belt of 40 to example 52 example 27-39 being 10cm in length. The result is shown in Table 4.

[0043]

[Table 4]

	組成 [原子%]	組織	厚さ [μm]	幅 [μm]	断面積 [mm²]	大ﾊﾞﾙﾄﾊｳｾﾞﾝ 不連続の有無	臨界磁界 (Oe)	検出パルス 電圧(mV)
実施例40	$Fe_{77}Si_8B_{15}$	非晶質	37	280	0.0088	有り	0.36	82
実施例41	$Fe_{77}Si_8B_{15}$	非晶質	41	260	0.0095	有り	0.31	76
実施例42	$Fe_{77}Si_8B_{15}$	非晶質	45	786	0.0300	有り	0.36	77
実施例43	$Fe_{77}Si_8B_{15}$	非晶質	15	700	0.0089	有り	0.35	73
実施例44	$Fe_{77}Si_8B_{15}$	非晶質	45	150	0.0057	有り	0.32	72
実施例45	$Fe_{63}Co_{14}Si_8B_{15}$	非晶質	32	296	0.0081	有り	0.32	80
実施例46	$Fe_{15}Co_{47}Si_8B_{15}$	非晶質	28	310	0.0074	有り	0.34	75
実施例47	$Fe_{60}Ni_{15}Si_8B_{15}$	非晶質	33	345	0.0097	有り	0.37	72
実施例48	$Fe_{60}Co_{10}Ni_{15}Si_8B_{15}$	非晶質	35	288	0.0096	有り	0.31	73
実施例49	$Fe_{60}Co_{15}Ni_{15}Si_7B_{15}$	非晶質	45	460	0.0197	有り	0.35	71
実施例50	$Co_{77.5}Si_{7.5}B_{15}$	非晶質	36	285	0.0097	有り	0.31	73
実施例51	$Fe_{72}P_{13}C_7Cr_3$	非晶質	31	315	0.0093	有り	0.33	84
実施例52	$Fe_{68}Zr_7B_8Cu_1Nb_1$	非晶質	26	327	0.0072	有り	0.34	78

[0044] As shown in Table 4, the Fe fellows machine amorphous thin belt of this invention reflects the peculiar cross-sectional form of this invention, even when length is set to 10cm. Size Barkhausen discontinuity was shown in the magnetic hysteresis curve, the critical magnetic field value at the time of magnetization reversal hardly changed to the case where length is 20cm, either, but the magnetic property of under 0.5 (Oe) was acquired for all. Therefore, the guidance pulse generated in a detector coil is also a wave-like sharp pulse, and it is clear that its all have the outstanding pulse voltage generating characteristic of 70mV or more, and are excellent in the characteristic to be detected.

[0045] About the alloy which consists of various composition shown in 53 to example 57 table 5, it heat-treated by producing a rapid cooling thin belt using the single rolling method like an example 1. The existence of the size Barkhausen discontinuity in an organization, Haba, thickness, a cross-section area, pulse voltage, and a magnetic hysteresis curve and the size of the critical magnetic field were measured like [belt / 7cm in length / thin] the example 1 about these produced thin belts. The result is shown in Table 5.

[0046]

[Table 5]

	組成 [原子%]	組織	厚さt [μm]	幅w [μm]	厚さと幅の比 t/w	断面積 [mm²]	大ﾊﾞﾙﾄﾊｳｾﾞﾝ 不連続の有無	臨界磁界 [Oe]	検出パルス 電圧(mV)
実施例53	$Fe_{77}Si_7B_{16}$	非晶質	35	690	0.051	0.020	有り	0.31	85
実施例54	$Fe_{77}Si_7B_{16}$	非晶質	45	280	0.161	0.011	有り	0.36	78
実施例55	$Fe_{77}Si_7B_{16}$	非晶質	45	150	0.300	0.006	有り	0.39	71
実施例56	$Fe_{63}Co_{14}Si_7B_{16}$	非晶質	33	605	0.055	0.017	有り	0.32	72
実施例57	$Fe_{53}Co_{24}Ni_8Si_7B_{16}$	非晶質	32	618	0.052	0.018	有り	0.30	73

[0047] As shown in Table 5, even when length was set to 7cm, reflecting the peculiar cross-sectional form of this invention, size Barkhausen discontinuity was shown in the magnetic hysteresis curve, and, as for the Fe fellows machine amorphous thin belt of this invention, as for each critical magnetic field value at the time of magnetization reversal, the magnetic

property of under 0.5 (Oe) was acquired. Therefore, the guidance pulse generated in a detector coil is also a wave-like sharp pulse, and it is clear that its all have the outstanding pulse voltage generating characteristic of 70mV or more, and are excellent in the characteristic to be detected.

[0048] It cut in length of 8.5cm using the thin belt used by 58 to example 83 example 1-13, and 27-39, and was considered as the magnetic body for pulse generating for magnetic markers. And these were put using the base material film of 25 micrometers in thickness, and 5mm in width polyethylene terephthalate with which it was applied to the adhesive, and the magnetic marker with a length of 9cm of the structure shown in drawing 6 was produced. A thin belt is held here at the state (even state) where it ******(ed) more. And the existence of size Barkhausen discontinuity was judged by measuring an exchange magnetic hysteresis curve about each produced magnetic marker in the magnetization magnetic field 0.01-1 (Oe) and the frequency of 60Hz. Furthermore, the pulse voltage generating characteristic of the produced magnetic marker magnetized the marker by the sine wave of the frequency of 50Hz, and the impression maximum magnetic field 1 (Oe), and measured the pulse voltage detected with 3.5cm in length, 590 turns, and the detector coil with an inside diameter of 3cm which were wound around the circumference of the marker. Various kinds of measurement results are collectively shown in Table 6 and Table 7.

[0049]

[Table 6]

	組成 [原子%]	組織	厚さ [μm]	幅 [μm]	厚さと幅との比	大ﾊﾞﾙｸﾊｳｾﾞﾝ不連続の有無	臨界磁界 (Oe)	検出パルス電圧(mV)
実施例58	$Fe_{78}Si_9B_{13}$	非晶質	35	652	0.054	有り	0.35	80
実施例59	$Fe_{78}Si_9B_{13}$	非晶質	16	800	0.020	有り	0.30	75
実施例60	$Fe_{78}Si_9B_{13}$	非晶質	43	295	0.146	有り	0.34	74
実施例61	$Fe_{78}Si_9B_{13}$	非晶質	15	728	0.021	有り	0.34	73
実施例62	$Fe_{78}Si_9B_{13}$	非晶質	44	150	0.293	有り	0.31	71
実施例63	$Fe_{67}Co_{11}Si_9B_{13}$	非晶質	25	610	0.041	有り	0.30	78
実施例64	$Fe_{13}Co_{60}Si_9B_{13}$	非晶質	28	615	0.046	有り	0.31	74
実施例65	$Fe_{60}Ni_{18}Si_9B_{13}$	非晶質	33	605	0.055	有り	0.34	71
実施例66	$Fe_{30}Co_{10}Ni_{18}Si_7B_{15}$	非晶質	32	618	0.052	有り	0.28	71
実施例67	$Fe_{30}Co_5Ni_{33}Si_7B_{15}$	非晶質	31	620	0.050	有り	0.31	72
実施例68	$Co_{72}Si_{13.5}B_{14.5}$	非晶質	33	605	0.055	有り	0.33	74
実施例69	$Fe_{78}P_{13}C_7Cr_2Mo_1$	非晶質	31	620	0.050	有り	0.34	71
実施例70	$Fe_{83}Zr_7B_7Cu_1Nb_2$	非晶質	33	605	0.055	有り	0.32	71

[0050]

[Table 7]

	組成 [原子%]	組織	厚さ [μm]	幅 [μm]	断面積 [mm²]	大バルクハウゼン・不連続の有無	臨界磁界 (Oe)	検出パルス電圧(mV)
実施例71	$Fe_{77}Si_9B_{14}$	非晶質	37	280	0.0088	有り	0.34	81
実施例72	$Fe_{77}Si_9B_{14}$	非晶質	41	260	0.0095	有り	0.30	75
実施例73	$Fe_{77}Si_9B_{14}$	非晶質	45	786	0.0300	有り	0.32	76
実施例74	$Fe_{77}Si_9B_{14}$	非晶質	16	700	0.0089	有り	0.31	72
実施例75	$Fe_{77}Si_9B_{14}$	非晶質	45	150	0.0057	有り	0.30	72
実施例76	$Fe_{30}Co_{30}Si_9B_{14}$	非晶質	32	296	0.0081	有り	0.29	78
実施例77	$Fe_{15}Co_{60}Si_9B_{14}$	非晶質	28	310	0.0074	有り	0.33	74
実施例78	$Fe_{60}Ni_{15}Si_9B_{14}$	非晶質	33	345	0.0097	有り	0.35	73
実施例79	$Fe_{30}Co_{30}Ni_{15}Si_9B_{14}$	非晶質	35	288	0.0096	有り	0.31	74
実施例80	$Fe_{30}Co_{15}Ni_{30}Si_7B_{18}$	非晶質	45	460	0.0197	有り	0.34	71
実施例81	$Co_{72.5}Si_{12.5}B_{15}$	非晶質	36	285	0.0097	有り	0.30	72
実施例82	$Fe_{77}P_{13}C_7Cr_3$	非晶質	31	315	0.0093	有り	0.33	80
実施例83	$Fe_{83}Zr_7B_9Cu_1Nb_3$	非晶質	26	327	0.0072	有り	0.33	71

[0051] As shown in Tables 6 and 7, the magnetic property length indicates size Barkhausen discontinuity to be in a magnetic hysteresis curve at least 9cm or less was acquired reflecting the thin belt which has the peculiar cross-sectional form of this invention being used for the magnetic marker of the example 58-83 of this invention. Therefore, the guidance pulse generated in a detector coil is also a wave-like sharp pulse, and all had the outstanding pulse voltage generating characteristic of 70mV or more. Moreover, all were below 0.5 (Oe) so that more clearly [the magnetic field (critical magnetic field) which produces the size Barkhausen discontinuity of each marker] than Tables 6 and 7.

[0052] The rapid cooling thin belt was produced using the single rolling method like the example 1 about the alloy which consists of various composition shown in 14 to example 84-93 and comparative example 16 table 8. And in 390 degrees C, where a twist of 0.025 to 30 times is given per 10cm, heat treatment for 10 minutes was given. Next, the existence of the size Barkhausen discontinuity in an organization, Haba, thickness, a cross-section area, pulse voltage, and a magnetic hysteresis curve and the size of the critical magnetic field were measured like [belt / 10cm in length / thin] the example 1 about these produced thin belts. The result is shown in Table 8.

[0053]

[Table 8]

	組成 [原子%]	組織	厚さt [μm]	幅w [μm]	厚さと幅の比 t/w	断面積 [mm²]	ねじれ回数 (回／10cm)	大バルクハウゼン不連続の有無	検出パルス電圧(mV)
実施例84	$Fe_{77}Si_7B_{16}$	非晶質	37	650	0.057	0.0187	1	有り	85
実施例85	$Fe_{77}Si_7B_{16}$	非晶質	18	800	0.023	0.0121	1.2	有り	79
実施例86	$Fe_{77}Si_7B_{16}$	非晶質	12	500	0.024	0.0051	0.5	有り	78
実施例87	$Fe_{77}Si_7B_{16}$	非晶質	15	700	0.021	0.0083	1.5	有り	79
実施例88	$Fe_{77}Si_7B_{16}$	非晶質	45	150	0.300	0.0052	0.1	有り	71
実施例89	$Fe_{66}Co_{10}Si_7B_{16}$	非晶質	25	610	0.041	0.0118	1	有り	82
実施例90	$Fe_{16}Co_{66}Si_7B_{16}$	非晶質	35	848	0.041	0.0239	3	有り	76
実施例91	$Fe_{66}Ni_{10}Si_7B_{16}$	非晶質	33	604	0.055	0.0160	1	有り	72
実施例92	$Fe_{66}Co_{10}Ni_6Si_7B_{16}$	非晶質	32	620	0.052	0.0159	1	有り	73
実施例93	$Fe_{77}P_{13}CrMo_2$	非晶質	32	615	0.052	0.0141	1	有り	85
比較例14	$Fe_{77}Si_7B_{16}$	非晶質	25	1750	0.014	0.0351	0.5	無し	56
比較例15	$Fe_{77}Si_7B_{16}$	非晶質	25	1750	0.014	0.0351	3	無し	45
比較例16	$Fe_{77}Si_7B_{16}$	非晶質	25	1750	0.014	0.0351	1	無し	36

[0054] As shown in Table 8, the magnetic property with which the number of times of a twist of a thin belt is 0.1 to 3 times / 10cm, and indicates size Barkhausen discontinuity to be in a magnetic hysteresis curve reflecting the cross-sectional form where the Fe fellows machine amorphous thin belt of this invention of the example 84-93 of this invention is peculiar was acquired. Therefore, the guidance pulse generated in a detector coil is also a wave-like sharp pulse, and all had the outstanding pulse voltage generating characteristic of 70mV or more. Moreover, the magnetic field (critical magnetic field) which produces the size Barkhausen discontinuity of the Fe basis amorphous thin belt of an example 84-93 was 0.2-0.5 (Oe). However, as shown in a comparative example 14-16, less than 0.015 section and the cross-section area of the ratio to Haba is 0.03mm2. [the thin belt which has the cross-sectional size to exceed] even if the number of times of a twist was 0.5 to 3 times / 10cm, size Barkhausen discontinuity was not shown in magnetic property, but the pulse voltage to generate was also markedly boiled compared with the example 84-93, and became low. [thus, the Fe fellows machine amorphous metal thin belt of this invention] Since the thin belt which has a specific cross-sectional form is heat-treated so that it may have the specific number of times of a twist, in the state where it was held in Taira and others, a critical magnetic field shows the size Barkhausen discontinuity below 0.5 (Oe), and is equipped with the characteristic which was excellent as a pulse generating element for magnetic markers.

[0055] About the alloy which consists of various composition shown in 94 to example 96 table 9, the rapid cooling thin belt was produced using the single rolling method like the example 1. And in 340 degrees C, heat treatment for 10 minutes was given in the state where a twist is not given. Next, the existence of the size Barkhausen discontinuity in an organization, Haba, thickness, a cross-section area, pulse voltage, and a magnetic hysteresis curve and the size of the critical magnetic field were measured like [belt / 10cm in length / thin] the example 1 about these produced thin belts. The result is shown in Table 9.

[0056]

[Table 9]

	組成 [原子%]	組織	厚さ [μm]	幅 [μm]	厚さと幅の比 t/w	断面積 [mm²]	大バルクハウゼン不連続の有無	臨界磁界 (Oe)	検出パルス電圧(mV)
実施例94	$Fe_{77}Si_{13}B_{10}$	非晶質	35	305	0.115	0.010	有り	0.16	71
実施例95	$Fe_{38}Co_{38}Si_{13}B_{10}$	非晶質	45	280	0.161	0.012	有り	0.15	72
実施例96	$Fe_{76}Co_{6}Si_{13}B_{10}$	非晶質	35	250	0.140	0.007	有り	0.12	71

[0057] As shown in Table 9, the magnetic property which shows size Barkhausen discontinuity in a magnetic hysteresis curve also in the state where torsion is not given reflecting the cross-sectional form where the FeFe fellows machine amorphous thin belt of this invention of the example 94-96 of this invention is peculiar, at the time of heat treatment was acquired. Therefore, the guidance pulse generated in a detector coil is also a wave-like sharp pulse, and all had the outstanding pulse voltage generating characteristic of 70mV or more. Moreover, the magnetic field (critical magnetic field) which produces size Barkhausen discontinuity was below 0.2 (Oe). Moreover, as for the thin belt of an example 94-96, it was checked that the magnetic property a critical magnetic field indicates [in / on 7cm and / in length / a magnetic hysteresis curve] the size Barkhausen discontinuity below 0.7 (Oe) to be is acquired. [thus, the Fe fellows machine amorphous metal thin belt of this invention] Since the thin belt which has a specific cross-sectional form is heat-treated under specific conditions, also in the thin belt which does not hold a twist after heat treatment, a critical magnetic field shows the size Barkhausen discontinuity below 0.7 (Oe), and is equipped with the characteristic which was excellent as a pulse generating element for magnetic markers.

[0058]

[Effect of the Invention] The amorphous metal thin belt of this invention shows the pulse voltage generating characteristic excellent in the detector coil, when the value of a critical magnetic field shows the size Barkhausen discontinuity below 0.7 (Oe) and length sets in a police box magnetic field also in 10cm or less. Moreover, since there is also little number of times of a twist of a thin belt, it is easy to treat, and even when the magnetic marker which held the thin belt in the even state with the film of an organic material etc. is produced, the practical magnetic marker a magnetic marker hardly indicates **** to be can be realized. Furthermore, the amorphous metal thin belt of this invention can be widely applied also to various magnetic sensors, such as a rotation sensor, and it is the industrial material in which the application to various sensor elements is possible as an unrealizable pulse generating element of a super-thin shape in the conventional amorphous metal small-gage wire.

[Translation done.]